Adage INC

ADAGE, INC.
HERB M. SPRAFKIN
BOX 31
WHITESTONE, NEW YORK
TELEPHONE: 212-539-7077

technical data

292 MAIN STREET • CAMBRIDGE 42, MASSACHUSETTS

MASS SPECTRUM DIGITIZER

Model VR16-MSD-1

INTRODUCTION

The Adage Mass Spectrum Digitizer, Model VR16-MSD, is a new instrument for automatic digital readout and recording of mass spectrometer data, providing heretofore unattainable speed and accuracy.

Using Adage's ultra-reliable circuitry and advanced signal-processing techniques, Model VR16-MSD detects signal peaks by "contour discrimination" while simultaneously rejecting noise peaks, with independently variable preset thresholds for the two processes. Under a wired-in control program, the same analog-to-digital converter is used to digitize both the peak amplitude of the detector amplifier output and the mass number (i.e., the reciprocal of the accelerating voltage). Each pair of digital values is printed and/or punched into paper tape.

The Model VR16-MSD is capable of detecting and measuring in this fashion more than 1,000 peaks per second, but is limited in practice by the response of the mass spectrometer detector amplifier and the speed of the recording device used. In a typical installation (references 1, 2), up to 5 peaks per second are routinely measured and digitally recorded.

The Adage Mass Spectrum Digitizer is available in several models to match exactly the signal characteristics of different mass spectrometers. Model VR16-MSD-1, with the specifications given here, has been designed for use with a CEC Model 21-103B Mass Spectrometer equipped with a Cary Model 36 vibrating-reed amplifier, and provides the speed and reliability required for both qualitative and quantitative analysis within limits imposed by the mass spectrometer itself.

The Mass Spectrum Digitizer utilizes standard Adage all-semiconductor circuitry and packaging techniques for the highest possible reliability. It is housed in two standard Adage cast aluminum enclosures, which together with a printer occupy one 30-inch high instrument rack. The optional tape punch may be either rack-mounted or bench-top style.

OPERATING PRINCIPLE

The VR16-MSD provides two modes of operation, a peak-reading mode and a continuous scan mode. In the peak-reading mode, the digitizer is capable of rejecting noise peaks below a threshold that can be selected by front panel switches from 0 to 1% of full scale. Whenever the input exceeds the threshold, a conversion is made and held until the input changes by an amount greater than a second manually selectable threshold. If the input continues to increase in magnitude, new conversions are initiated until a peak occurs and the input reverses its direction. At this time a signal is generated that transfers the last conversion value to a buffer register and the converter, operating as a ratiometer, then measures the mass number.

Upon completion of the mass number measurement, both the peak height and the mass number are recorded. (In addition to digital printer and punched paper tape logging, Adage can provide for magnetic tape logging or direct computer entry.) Once a peak has been recorded, the peak height digitizer will no longer command a print cycle until the input again starts to increase. It is not necessary for the input to return to zero to enable detection of another peak.

In the continuous scan mode of operation, the Adage Mass Spectrum Digitizer alternately digitizes the spectrometer detector amplifier output signal and the mass number. Either value, as selected by a switch on the control panel, is displayed on long-life "Nixie" lamps. This allows the VR16-MSD to be used conveniently as a monitor during initial set-up of the mass spectrometer and associated equipment.

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SPECIFICATIONS

Model VR16-MSD-1

Matches voltages from CEC Model 21-103B Mass Spectrometer equipped with a Cary Model 36 vibrating-reed amplifier.

Input voltage range A (from detector amplifier)	0.000 to -9.999 volt
Input voltage range B (from accelerating voltage attenuator)	0.000 to +9.999 volts
Mass number range ratio	10 to 1
Mass number resolution	0.1 mass number unit
Conversion rate	10,000 independent conversions per second
Voltage-to-digital conversion time	80 microseconds
Peak rate (Limited by input from detector amplifier and output to printer/punch)	5 peaks/second
Visual output	"Nixie" display of each digital conversion
Logging output	1. Digital printer 2. Tape punch (optional)
Modes of operation	1. Peak-reading mode, Automatic logging 2. Continuous scan mode, Visual display

ACCURACY

The voltage-to-digital conversions are accurate to ±0.01% of full scale plus 1/2 of the least significant digit.

A sampling error of similar magnitude may result when an actual peak signal occurs during the time (not more than 80 microseconds) required for a single voltage-to-digital conversion. The value of this error is usually negligible, and will never exceed the value of the expression

$$E = \frac{80 \times 10^{-4} \text{ sec.}}{\text{full scale voltage}} \times \frac{dv}{dt}$$

where E is the error in % full scale and dv/dt equals the rate of change of signal voltage in the vicinity of a peak.

In general, the accuracy of the digital output from the Adage Mass Spectrum Digitizer is limited by the accuracy of the input signal and by the assumption that the mass number is inversely proportional to the accelerating voltage.

REFERENCES

(1) Klaver, R.F., and LeTourneau, R.L., "A Fast Mass Spectrum Digitizer for a Gas Chromatograph-Mass Spectrometer Combination," presented to the API Division of Refining, May 1963.

(2) Klaver, R.F., and Teeter, R.M., "A New Digitizer for Mass Spectra," presented to the ASTM Committee on Mass Spectrometry, May 1963.

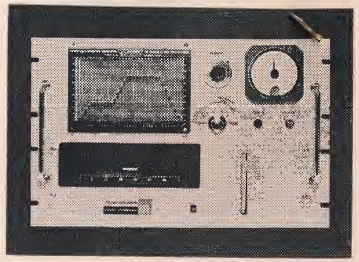
The Mass Spectrum Digitizer is available from Adage, Inc. under a license arrangement with California Research Corporation.

May 1, 1963
Specifications subject to
change without notice.

PROGRAMMABLE-WAVEFORM ANALOG OUTPUT DEVICE Prob. suitable for electronic music

an ac line volt... meter transfer switch frequency meter, voltage regulator, and an exciter field rheostat. **Columbia Electric Mfg. Co.,** 4519 Hamilton Ave., Cleveland, Ohio 44114.

Circle 473 on Free Service Card



Analog Programmer

Self-contained programmer can provide complex temperature or pressure programs as well as function generation in an analog computer. Operating from 115 volts ±10 per cent, 60 cycle lines, the programmer allows the setting of empirical functions or multiple slope reversals from a 34 pole, 100 position switch. The program output is plotted against a time base with accuracies of ±0.5 per cent of full scale. Device features flexibility of displaying the fixed program as well as allowing the change of program under dynamic loading conditions. **Electronic Products Div., Perkin-Elmer Corp.,** Main Ave., Norwalk, Conn.

Circle 474 on Free Service Card

Solid State Transducers

Line of solid state transducers produces a high-level dc output that can be applied to graphic recording instruments, panel instruments, switchboard indicating instruments, portable indicating standards, telemetering systems, and computers. Current transducers directly meas-